PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2000-279727

(43)Date of publication of application : 10.10.2000

(51)Int.Cl. B01D 39/16
D04H 1/54

(21)Application number : 11-088794

(22)Date of filing : 30.03.1999

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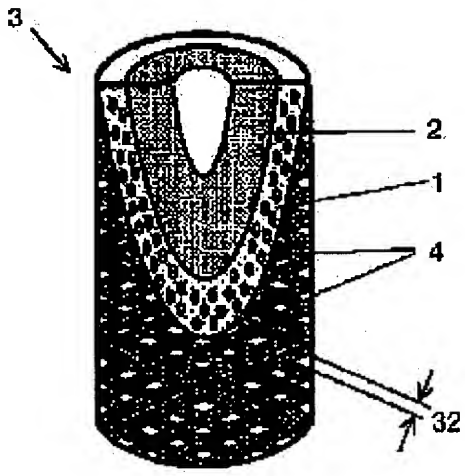
(54) FILTER CARTRIDGE

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a filter cartridge 3 which has high accuracy and long filtration life and obviates the inclusion of foreign matter in a filtrate by providing the filter cartridge with a filter layer which is formed by winding a belt-like long fiber nonwoven fabric formed by using thermoplastic fibers and adhering their fiber intersection points to a cylindrical shape like a twill and another filter layer which is specified in a grain size.



SOLUTION: The filter cartridge 3 is formed of at least the two layers; the filter layer 1 which is formed by winding the belt-like long fiber nonwoven fabric formed 4 by using the thermoplastic fibers and adhering their fiber intersection points to the cylindrical shape like the twill and another filter layer 2 which has an initial 80% captured grain size of 0.05 to 0.9 times the initial 80% captured grain size of the filter layer 1. The filter layer 2 is arranged on the downstream side of the filter layer 1. When the fluid is passed from, for example, the outer side of the cylinder to the inner side, the filter layer 1 is arranged on the outer peripheral side of the filter layer 2. All thermoplastic resins which allow melt spinning are usable for the thermoplastic fibers forming the long fiber nonwoven fabric 4. Such resins are preferably thermally adhesive composite fibers of ≥10°C in a melting point difference.

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention twists [that the foreign matter of a filtering-medium defluxion object and others mixes in liquid filtration especially into filtrate about a useful filter cartridge] and is highly precise, and a filtration life is related with a long filter cartridge.
[0002]
[Description of the Prior Art] Various filters are developed and produced in order to purify a fluid now. Especially, the cartridge type filter (it abbreviates to a filter cartridge below) with easy exchange of a filtering medium is used in the broad field on industries, such as removal of the suspension particle in an industrial use liquid raw material, removal of the cake which flowed out of surface filtration equipment, and purification of industrial water.
[0003] The kind of some [structure / of a filter cartridge / former] is proposed. A spool type filter cartridge is the most typical especially. After this twists the spun yarn used as a filtering medium around a perforated cylinder-like core in the shape of Aya, it is the filter cartridge of the shape of a cylindrical shape which spun yarn is fluffed and is made, and is used from manufacture being easy and being cheap for many years. There is a nonwoven fabric laminating type filter cartridge as another structure. This is the filter cartridge of the shape of a cylindrical shape which winds gradually some kinds of nonwoven fabrics, such as a carding nonwoven fabric, around a perforated cylinder-like core in the shape of a concentric circle, and is made, and several sorts are put in practical use by development of the latest nonwoven fabric manufacturing technology.
[0004] However, these filter cartridges also have some faults. For example, although the foreign matter uptake method of a spool type filter cartridge carries out the uptake of the foreign matter by the fluff generated from spun yarn and it is said in the gap of spun yarn that a foreign matter is entwined, since the size of a fluff and a gap and formal adjustment are difficult, there is a fault that a limitation is in the size and amount of a foreign matter which can carry out a uptake. Moreover, since spun yarn is made from a staple fiber, when a fluid flows to a filter cartridge, it has the fault that the composition fiber of spun yarn drops out. Furthermore, in case spun yarn is manufactured, in order to prevent the staple fiber used as a raw material adhering to a spinning machine by causes, such as static electricity, the surfactant of a minute amount is applied to a front face in many cases. When a liquid is filtered by the filter cartridge made from the spun yarn which applied such a surfactant, it may have a bad influence on the cleanliness of liquid, such as an increase in foaming of liquid, TOC (the amount of total organic carbon) and COD (chemical oxygen demand), and electrical conductivity. Moreover, a price is high as a result and spun yarn has a bird clapper in order to spin and make a staple fiber and to require the spinning of a staple fiber, and the process of at least 2 stages of spinning, as point ** was carried out.
[0005] Moreover, as for the filter cartridge of the structure which twisted the double-width nonwoven fabric around the surroundings of a perforated tube-like object as shown in drawing 2 in the shape of a sushi roll with seaweed as it was, and the so-called nonwoven fabric laminating type filter cartridge, the performance is decided by the nonwoven fabric. After manufacture of a nonwoven fabric carries out the

confounding of the staple fiber with a carding machine or an air RAID machine, it is performed in many cases by the method of making it into direct nonwoven fabrics, such as the method of heat-treating and making from a hot blast heating machine, a heating roller, etc. if needed, or the melt blowing method, and the span bond method. However, the unevenness of nonwoven fabric physical properties, such as eyes, produces any machine used for nonwoven fabric manufactures, such as a carding machine, an air RAID machine, a hot blast heating machine, a heating roller, a melt blow machine, and a span bond machine, in many cases in the machine cross direction. Therefore, a filter cartridge becomes poor [quality], or using the advanced manufacturing technology for abolishing unevenness, a manufacturing cost is high and there is a bird clapper. Moreover, since it is necessary to use about 2-6 kinds per form of nonwoven fabrics for a nonwoven fabric laminating type filter cartridge, and to use a further different nonwoven fabric according to the form of a filter cartridge, also by it, a manufacturing cost is high and there is a bird clapper. Moreover, in the case of a nonwoven fabric laminating type filter cartridge, when the performance of the nonwoven fabric to be used is not in agreement with the particle properties in front [filtration] liquid, there is also a problem of being easy to carry out surface lock out.

[0006] Some methods are proposed in order to solve the trouble of such a conventional filter cartridge. For example, the filter cartridge of the form which wound around the porous container liner the filtration material which crushed, narrowed down and regulated the diameter to about 3mm in close Aya is proposed by JP,6-7767,Y, adding a twist to the paper of the shape of a tape which has porosity. There is the feature that the volume pitch of winding can be enlarged as it goes outside a porous container liner in this method. However, since it is necessary to crush and narrow down a filtration material, therefore the uptake of a foreign matter is performed mainly between the volume pitches of a filtration material, it is hard to expect the foreign matter uptake by the filtration material itself to which the spool type filter which used conventional spun yarn was carrying out the uptake of the foreign matter by the fluff. Thereby, surface lock out is carried out, a filtration life may become short or a filter may be inferior to dipping nature.

[0007] The filter of the form where JP,1-115423,A was made to wind as an option the string-like object which judged the cellulose span bond nonwoven fabric to the band form, and added the through twist for **** around the bobbin with which **** drilling of the pore was carried out is proposed. It is thought that mechanical strength is high compared with the roll tissue filter which made the tissue paper the alpha cellulose which refined conventional needle-leaf tree pulp, and twisted it in the shape of a roll if this method is used, and a filter without the dissolution by water or elution of a binder can be made. However, since the cellulose span bond nonwoven fabric used for this filter is carrying out the paper-like gestalt, it has rigidity too much, and the foreign matter uptake by the filtration material itself to which the conventional spool type filter was carrying out the uptake of the foreign matter by the fluff cannot expect it easily. Moreover, since the cellulose span bond nonwoven fabric is carrying out the paper-like gestalt, it is easy to swell it in liquid, and various problems, such as change of filter strength reduction and a filtration accuracy, aggravation of dipping nature, and reduction of a filtration life, may produce it by swelling. Moreover, although adhesion of the fiber intersection of a cellulose span bond nonwoven fabric is performed in many cases by chemical processing etc., since there are many the causes and bird clappers of defluxion [**** / becoming the cause of change of a filtration accuracy] of fiber waste, it is insufficiently difficult / the adhesion has many bird clappers, and / for it to obtain the stable filtration efficiency.

[0008] Furthermore, the filter which twisted the slit nonwoven fabric to which 10% of the weight or more of composition fiber becomes JP,4-45810,A from the bicomponent fiber currently divided into 0.5 deniers or less so that fiber density might be set to 0.18-0.30 on porous **** is proposed. When this method is used, there is the feature that the fine particle in a liquid can be caught by fiber with small fineness. However, it is difficult for it to be necessary to use the physical stress of high-pressure water etc., in order to make a bicomponent fiber divide, and to make it divide into homogeneity over the whole nonwoven fabric in high-pressure water processing. Since a difference arises in a uptake particle diameter in the part which it is [in a nonwoven fabric] good and was divided, and the part where division is inadequate when not divided uniformly, a filtration accuracy may become coarse. Moreover,

since nonwoven fabric intensity may fall with the physical stress to be used in case it divides, the intensity of the made filter falls, it may become, or the voidage of a filter may change that it is easy to deform while in use, and dipping nature may fall. Furthermore, since adjustment of the tension at the time of nonwoven fabric intensity twisting on porous **** with a low becomes difficult, adjustment of delicate voidage is difficult and there is a bird clapper. Furthermore, since the manufacturing cost of a filter becomes high by the spinning technology demanded in order to make ****** fiber, or the operation increase in cost at the time of manufacture, Although it will be thought that it can be used for a part of field as which an advanced filtration efficiency like medicine manufacture industry or electronic industry is required if the technical problem on a filtration efficiency which carried out point ** is solved It is considered for use to be difficult for the use searched for that a filter is cheap like filtration of pool water or filtration of the plating liquid for galvanizer business.

[0009] On the other hand, apart from these devices, the attempt which is going to make a filtering medium multilayer structure and is going to improve the performance of a filter also occurs. For example, the method of making the tubed cartridge filter which becomes JP,4-131412,U, JP,4-131413,U, and JP,5-2715,U from several layers using the nonwoven fabric containing the super-thin fiber obtained by dividing an assembled-die bicomponent fiber is indicated. The layer structure consists of what consists of a nonwoven fabric winding layer containing super-thin fiber, and a spun-yarn layer (JP,4-131412,U), the thing (JP,4-131413,U) which consists of a layer which merged and twisted the slit nonwoven fabric winding layer and slit nonwoven fabric containing super-thin fiber, and thread, and a spun-yarn winding layer, a slit nonwoven fabric winding layer containing super-thin fiber, and a slit nonwoven fabric winding layer which has a diameter of fiber more than the double precision. Since each of these filters has multilayer structure, although a filtration life is longer than the filter which consists of monolayer structure and a bird clapper is expected, the trouble by having used division fiber which carried out point ** is not solved.

[0010] moreover -- JP,4-30007,U -- much circulation -- the filter element of two-layer structure equipped with the core which has a hole, the pleat filter which folded up the surface filtering medium of the periphery many times, and was made endless, and the spool filter of the periphery is indicated However, since spun yarn is used for this filter element, the trouble by having used spun yarn which carried out point ** is not solved.

[0011] Although some methods were learned in addition to this about the filter of multilayer structure, the thing [they] with [each] emphasis on the inside of each class and the highly precise layer was almost the case. That is, although full use of a variously advanced device is made about the highly precise layer, it is the grade which is observing the size of a filtration accuracy about the other layer, and so much device is not made in many cases. For example, since the defluxion of composition fiber or the problem of foaming from a filtering medium which spun yarn which carried out point ** has are not still solved when spun yarn is used for layers other than a highly precise layer, by having made it multilayer structure, a performance may become bad on the contrary rather than the filter currently made only from the highly precise layer, or a use may be restricted. When material other than spun yarn is used and the conventional filtering medium is used for layers other than a highly precise layer, it becomes what succeeds the trouble of the conventional filtering medium as it is, or there are many bird clappers very at an expensive price. Moreover, also in the filter of multilayer structure made by those methods, the further improvement of the fundamental property of a filter of the life and water flow nature of a filter was called for.

[0012]

[Problem(s) to be Solved by the Invention] The technical problem of this invention is highly precise, and its filtration life is long, and it is to offer the filter cartridge which the foreign matter of a filtering-medium defluxion object and others does not mix into filtrate.

[0013] The first filter layer which twisted around the cylindrical shape the band-like continuous-glass-fiber nonwoven fabric which consisted of thermoplastic fiber and a part of the fiber intersection [at least] has pasted up as a result of this invention persons' doing research and development wholeheartedly, in order to solve the aforementioned technical problem in the shape of Aya, By

considering as the filter cartridge which consists of the second filter layer highly precise than the first filter layer located in a downstream (side near filtrate) rather than the first filter layer It found out that it was possible to obtain the tubed filter cartridge excellent in the stability of dipping nature, a filtration life, and a filtration accuracy etc., and this invention was reached.
[0014]
[Means for Solution] this invention has the following composition.
(1) The filter cartridge which consists of the first filter layer which comes to twist around a cylindrical shape the band-like continuous-glass-fiber nonwoven fabric which consisted of thermoplastic fiber and a part of the fiber intersection [at least] has pasted up in the shape of Aya, and the second filter layer whose initial 80% uptake particle size is 0.05 to 0.9 times [of the first filter layer] the initial 80% uptake particle size.
(2) A filter cartridge given in (1) term which is the heat adhesive property bicomponent fiber whose melting point difference of both those resins thermoplastic fiber consists of a low melting point resin and a high-melting point resin, and is 10 degrees C or more.
(3) a low melting point resin -- a line -- a filter cartridge given in (2) terms whose high-melting point resin it is a low density polyethylene and is polypropylene
(4) A filter cartridge given in any 1 term of (1) - (3) term which the fiber intersection has pasted up by the thermocompression bonding according [a band-like continuous-glass-fiber nonwoven fabric] to a heat embossing roll.
(5) A filter cartridge given in any 1 term of (1) - (3) term which the fiber intersection has pasted [the band-like continuous-glass-fiber nonwoven fabric] up by hot blast.
(6) A filter cartridge given in any 1 term of (1) - (5) term by which the twist was added to the band-like continuous-glass-fiber nonwoven fabric.
(7) A filter cartridge given in any 1 term of (1) - (5) term which used the band-like continuous-glass-fiber nonwoven fabric as the rib-like object which has the rib of 4-50, and was twisted around the perforated tube-like object in the shape of Aya.
(8) A filter cartridge given in (7) terms to which a part of rib [at least] of a rib-like object is not parallel.
(9) A filter cartridge given in (7) terms whose voidage of a rib-like object is 60 - 95%.
(10) A filter cartridge given in any 1 term of (1) - (9) term whose voidage of the first filter layer of a filter cartridge is 65 - 85%.
(11) A filter cartridge given in any 1 term of (1) - (10) term whose product of the eyes (g/m2) of width of face (cm) and a band-like continuous-glass-fiber nonwoven fabric a band-like continuous-glass-fiber nonwoven fabric carries out the slit of the continuous-glass-fiber nonwoven fabric of latus width of face, and is obtained, and the width of face is 0.5cm or more, and is 200 or less.
(12) A filter cartridge given in (1) term whose second filter layer is that around which the perforated sheet is wound in the shape of a sushi roll with seaweed around the perforated tube-like object.
(13) a filter layer which twisted around the cylindrical shape the band-like continuous-glass-fiber nonwoven fabric which the second filter layer became the surroundings of a perforated tube-like object from thermoplastic fiber, and a part of the fiber intersection [at least] has pasted up in the shape of Aya, It is the two-layer structure which consists of a b filter layer continuously twisted around the cylindrical shape in the shape of Aya in the band-like continuous-glass-fiber nonwoven fabric from a filter layer while involving in the perforated sheet in the shape of a sushi roll with seaweed. A filter cartridge given in (1) term which is the filter layer by which the first filter layer was continuously twisted around the cylindrical shape in the shape of Aya in the band-like continuous-glass-fiber nonwoven fabric from the second filter layer.
(14) A filter cartridge given in (1) term by which the second filter layer bends a perforated sheet in the shape of a pleat around a perforated tube-like object, and is fabricated by tubed.
(15) the -- two -- a filter layer -- the melting point -- a difference -- ten -- degree C -- more than -- two -- a sort -- thermoplastics -- from -- becoming -- heat -- an adhesive property -- a bicomponent fiber -- from -- becoming -- and -- heat -- an adhesive property -- a bicomponent fiber -- an intersection --

pasting up -- having had -- tubed -- a Plastic solid -- it is -- (-- one --) -- a term -- a publication -- a filter cartridge .
[0015]
[Embodiments of the Invention] Hereafter, the mode of this invention is explained concretely.
[0016] the first filter layer which comes to twist around a cylindrical shape the band-like continuous-glass-fiber nonwoven fabric (henceforth a band-like continuous-glass-fiber nonwoven fabric) which the filter cartridge of this invention consisted of thermoplastic fiber, and a part of the fiber intersection [at least] has pasted up in the shape of Aya, and the second filter layer whose initial 80% uptake particle size is 0.05 to 0.9 times the initial 80% uptake particle size of the first filter layer -- it consists of two-layer at least The second filter layer is located in a downstream (side near filtrate) rather than the first filter layer. Drawing 1 is the example of an about when pouring a fluid inside from a cylindrical outside, and the first filter layer 1 is located in the periphery side of the second filter layer 2. When the pressure resistance of the second filter layer is weak, of course, it does not matter even if it makes it the three-tiered structure or the double layer structure beyond it which could prepare the perforated core for on-the-strength maintenance, and prepared the third filter layer in the range which does not bar the effect of this invention. When making it the structure of three or more layers, the layers aiming at except for a particle uptake, such as an activated carbon layer, may be prepared, or extension of the further filtration life may be aimed at for the initial 80% uptake particle size of the third filter layer as 0.05 to 0.9 times of initial 80% uptake particle size of the second filter layer.
[0017] Uptake particle size is explained initial 80% first here. The initial 80% uptake particle size of a certain filter is a particle size from which the particle collection efficiency in the particle size becomes 80% exactly. It is ASTM although there are various methods in the way of asking. The method of F795-88 is reliable. After the outline attaches a filter in a circulating filtration-efficiency testing machine etc., carries out water-flow circulation with a pump, passes the liquid (front [filtration] liquid) which made cakes, such as AC fine test dust, become muddy in a filter, obtains filtrate and dilutes the liquid before filtration, and filtrate with a suitable scale factor, it computes the initial collection efficiency in each particle size by measuring the number of the particles contained in each liquid by the optical interception formula particle detector. In this specification, the particle size with which interpolate the value and a collection efficiency indicates 80% to be is defined as uptake particle size initial 80%. Since an initial collection efficiency increases in monotone to particle size in many cases, uptake particle size can be uniquely found with each filter initial 80% in that case. Although two or more particle size from which an initial collection-efficiency curve does not become a monotonous increase rarely, but a particle collection efficiency becomes 80% exactly may exist, let smallest particle size in it then be 80% uptake particle size of the filter.
[0018] In addition, it is difficult to measure the initial 80% uptake particle size for every layer as it is, maintaining the configuration of a filter cartridge, since the filter cartridge of this invention was structure which consists of the first filter layer and the second filter layer. Then, it asks by the following two methods.
[0019] A primary method is a method of manufacturing the first filter layer and the second filter layer to according to, respectively. This method can be used when the manufacture conditions of each layer are known. When a configuration is unmaintainable only in each layer, it is good for a suitable dummy, for example, inside, to use the perforated plastics cast of a cavity etc.
[0020] The second method is a method of analyzing and asking for measurement data. When the manufacture conditions of each layer are not known, it is good to use this method. First, the collection efficiency of the filter cartridge in each particle size is measured. Next, the first filter layer is removed from a filter cartridge, and it is made only the second filter layer. The relation of the collection efficiency of the first filter layer, the second filter layer, and a filter cartridge follows the following formula.
[0021] (Collection efficiency of 1-filter cartridge) =(collection efficiency of the 1-first filter layer) x (collection efficiency of the 1-second filter layer)
[0022] Therefore, if the collection efficiency of a filter cartridge and the second filter layer can be found,

it can ask for the collection efficiency of the first filter layer analytically. Probably, it will be clear that it can ask when the layer is three or more layers, if this method is applied. What is necessary is to compute the collection efficiency in each particle size of each layer by this method, to interpolate the value and just to compute uptake particle size initial 80%. Moreover, if it is difficult to remove the first filter layer, even if it removes and measures the second filter layer, it can ask similarly.

[0023] All the thermoplastics in which melt spinning is possible can be used for the thermoplastic fiber which constitutes the band-like continuous-glass-fiber nonwoven fabric used by this invention. as the example -- polypropylene, a low density polyethylene, a high density polyethylene, and a line -- a low density polyethylene and copolymerization polypropylene (for example, a propylene is made into a subject) System resins, such as duality or plural copolymers with ethylene, butene-1, and 4-methyl pentene-1 grade including a polyolefine, Polyester system resins including these low melting point polyester that also added the isophthalic acid and copolymerized the polyethylene terephthalate, the polybutylene terephthalate, and the acid component in addition to the terephthalic acid, Thermoplastics, such as polyamide system resins, such as nylon 6 and Nylon 66, a polystyrene system resin (atactic polystyrene, syndiotactic polystyrene), a polyurethane elastomer, a polyester elastomer, and a polytetrafluoroethylene, can be shown. Moreover, the resin of functionality can also be used, such as giving biodegradability to a filter cartridge using biodegradability resins, such as lactic-acid system polyester. Moreover, if the resin which carried out the polymerization with the metallocene catalyst is used when using the resin which can carry out a polymerization with metallocene catalysts, such as a polyolefine system resin and polystyrene, since the property of metallocene resins, such as reduction of improvement in nonwoven fabric intensity, chemical-resistant improvement, and production energy, is harnessed in a filter cartridge, it is desirable. Moreover, in order to adjust the heat adhesive property and rigidity of a continuous-glass-fiber nonwoven fabric, you may blend and use these resins. Also in these, when using a filter cartridge for filtration of the liquid of the drainage system of ordinary temperature, polyolefine system resins including the point of chemical resistance and a price to polypropylene are desirable, and when using it for comparatively hot liquid, a polyester system resin, a polyamide system resin, or syndiotactic polystyrene resin is desirable.

[0024] As for the aforementioned thermoplastic fiber used by this invention, it is desirable that it is the heat adhesive property bicomponent fiber which 10 degrees C or more of 15 degrees C or more of melting point differences become from a certain low melting point resin and high-melting point resin preferably. In order to dissolve a part of single fiber by using a heat adhesive property bicomponent fiber at the time of heat adhesion, the configuration of a pasting up point is smooth and heat adhesion of the fiber junction of a nonwoven fabric is stable. Possibility that the particle caught near the fiber junction when the nonwoven fabric obtained was used for a filter cartridge and filtration pressure and the amount of water flow went up will flow out becomes small. Moreover, deformation of a filter cartridge becomes small, when fiber deteriorates temporarily with the matter further contained in filtrate, the probability that fiber will drop out becomes small, and the danger that a resin will mix in the filtrate by collapse of a pasting up point will become fewer. Although there is especially no upper limit of a melting point difference, the temperature gradient of the resin of the highest melting point and the resin of the minimum melting point corresponds among the thermoplastics in which melt spinning is possible. In addition, in being the resin with which the melting point does not exist, it considers that a flow beginning temperature is the melting point.

[0025] The combination of the low melting point resin of the aforementioned heat adhesive property bicomponent fiber, and a high-melting point resin It is not what will be limited especially if there are 15 degrees C or more preferably [10 degrees C or more of melting point differences]. a line -- a low density polyethylene/polypropylene, and a high density polyethylene/polypropylene -- A low density polyethylene/polypropylene, the copolymer/polypropylene of a propylene and other alpha olefins, a line -- a low density polyethylene/high density polyethylene, and a low density polyethylene/high density polyethylene -- Various kinds of polyethylene/thermoplastic polyesters, polypropylene/thermoplastic polyester, Copolymerized polyester/thermoplastic polyester, various kinds of polyethylene/nylon 6, polypropylene/nylon 6, nylon 6 / Nylon 66, nylon 6/thermoplastic polyester, etc. can be raised. inside --

a line -- when the combination of a low density polyethylene/polypropylene is used, since regulation can be easily done at the process of adhesion of the rigidity of a continuous-glass-fiber nonwoven fabric, and adjustment of voidage of the fiber intersection at the time of nonwoven fabric manufacture, it is desirable Moreover, when using it for comparatively hot liquid, the combination of the low melting point polyester / polyethylene terephthalate which also added the isophthalic acid and copolymerized the acid component in addition to the terephthalic acid can also be used suitably.
[0026] The continuous-glass-fiber nonwoven fabric used for a band-like continuous-glass-fiber nonwoven fabric by this invention is a continuous-glass-fiber nonwoven fabric obtained by the span bond method etc. Since the grain direction has gathered in the direction of a machine as the continuous-glass-fiber nonwoven fabric made by the span bond method etc. is shown in drawing 14 , the hole which consists of fiber 23 becomes long and slender, and the maximum passage particle 24 will become small. Since in the case of the nonwoven fabric which consists of a staple fiber obtained by the card method etc. to it the grain direction is not fixed as shown in drawing 15 , the hole which consists of fiber 25 serves as a form near a circle or a square, and even if the continuous-glass-fiber nonwoven fabric and hole density which were made by the span bond method etc. are the same, it becomes what has the large maximum passage particle diameter 24. Since it will be mostly decided by hole density if the water flow nature of a filtering medium has the the same diameter of fiber, the filter excellent in water flow nature is obtained by using the continuous-glass-fiber nonwoven fabric made by the span bond method etc. Since this effect becomes small when a binder which closes holes of a filtering medium, such as adhesives, is used, use of a cellulose span bond nonwoven fabric is not desirable. Moreover, when the cellulose span bond nonwoven fabric was used and filtration pressure goes up by causes, such as blinding of a filter, since the intensity of a nonwoven fabric becomes weak, there is a problem of becoming easy to transform the hole which consists of fiber. Moreover, since unlike many staple-fiber nonwoven fabrics it is a continuous glass fiber and there is almost no defluxion of a filtering medium excluding a low-molecular component like a fiber surface agent (for example, surfactant) that there are very few edges of fiber, the continuous-glass-fiber nonwoven fabric which consisted of thermoplastic fiber and a part of the fiber intersection [at least] has pasted up has very little possibility that filtrate will be polluted, as compared with other materials, if this is used for a filtering medium.
[0027] Although it is hard to ****** it generally since the single-yarn fineness of an average of the aforementioned continuous-glass-fiber nonwoven fabric used by this invention changes with the use of a filter cartridge, or kinds of resin, its range of 0.6 - 3000dtex is desirable. If 3000dtex(es) are exceeded for fineness, a difference with the case where what only bundled the continuous fiber is used will be lost, and the meaning using a continuous-glass-fiber nonwoven fabric will be lost. Moreover, since sufficient nonwoven fabric intensity can be obtained by being referred to as 0.6 or more dtexes, the intensity of the filter cartridge which could make it easy to process this nonwoven fabric into a rib-like object, and was further made by the method of mentioning later becomes large and is also desirable. Moreover, when it is going to carry out spinning of the fiber of the fineness of less than 0.6 dtexes by the present span bond method, the processability and spinnable properties of a nozzle which are used become bad, the price of the span bond nonwoven fabric manufactured as a result is high, and there is a bird clapper.
[0028] The composition fiber of the aforementioned continuous-glass-fiber nonwoven fabric used by this invention does not necessarily need to be a circular cross section, and can also use variant cross-section thread. In this case, since the uptake of a minute particle increases so that the surface area of a filter is large, it can make a highly precise filter cartridge from the dipping nature more nearly same than the case where the fiber of a circular cross section is used.
[0029] moreover, since dipping nature will improve in using it for the liquid of a drainage system if hydrophilic resins, such as polyvinyl alcohol, are mixed with the raw material resin of the aforementioned continuous-glass-fiber nonwoven fabric, or plasma etching is carried out to the aforementioned continuous-glass-fiber nonwoven face side and a continuous-glass-fiber nonwoven fabric is hydrophilicity-ized in the range which does not bar the effect of this invention, solution is filtered -- the filter which used such a resin for the case is desirable
[0030] The thermal-bond method of the fiber intersection of the aforementioned continuous-glass-fiber

nonwoven fabric used by this invention can mention the method using heat setting machines, such as the method of carrying out thermocompression bonding using equipment like a heat embossing roll and a heat flat calendering roll, a hot blast circulation type, a heat through air type, an infrared heater type, and the vertical direction hot blast jet type, etc. The method using a heat embossing roll makes [improvement in the manufacture speed of a nonwoven fabric can be performed, and / productivity is good and] cheap cost and is desirable especially.

[0031] Furthermore, as shown in drawing 3 , the portion 5 in which the continuous-glass-fiber nonwoven fabric built by the method using a heat embossing roll has the strong thermocompression bonding by the embossing pattern, and the portion 6 only with the weak thermocompression bonding by having shifted from the embossing pattern exist. By this, the uptake of many foreign matters 7 and 8 can be carried out in the portion 5 with strong thermocompression bonding. although the uptake of some foreign matters is carried out in the portion 6 which has only weak thermocompression bonding on the other hand -- the remaining foreign matters -- a continuous-glass-fiber nonwoven fabric -- passing . -- since it can move to the following layer, it becomes the depth-type-filtration structure used to the interior of a filtering medium and is desirable

[0032] In this case, as for the area of an embossing pattern, considering as 5 - 25% is desirable. by making this area into 5% or more, the effect by the thermal bond of a fiber intersection which carried out point ** can be raised, and it stops that the rigidity of a nonwoven fabric becomes large too much by considering as 25% or less -- it can make it easy that things are made or a foreign matter passes a continuous-glass-fiber nonwoven fabric to some extent, and the passed foreign matter can extend a filter life by catching inside a filter

[0033] Moreover, after processing the configuration of a filter cartridge by the method shown later, you may carry out heat adhesion of the fiber intersection by infrared radiation, steam processing, etc. Or although a fiber intersection can also be chemically pasted up using adhesives, such as an epoxy resin, since hole density becomes low as compared with the case where a thermal bond is carried out, dipping nature may fall.

[0034] 5 - 200 g/m2 of a weight is desirable per eyes of the aforementioned continuous-glass-fiber nonwoven fabric used by this invention, i.e., a nonwoven fabric unit area. If this value is less than two 5 g/m, since the amount of fiber will decrease, the unevenness of a nonwoven fabric becomes large, or the thermal bond of a fiber intersection in which the intensity of a nonwoven fabric fell or carried out point ** is difficult, and there is a bird clapper. If this value exceeds 200 g/m2, since the rigidity of a nonwoven fabric will become large too much, it is hard coming to twist around a perforated tube-like object on the other hand in the shape of Aya behind.

[0035] The continuous-glass-fiber nonwoven fabric used by this invention is beltlike. Although the method of adjusting spinning width of face and making a direct band-like nonwoven fabric can also be used in order to obtain a band-like continuous-glass-fiber nonwoven fabric, it is using the method of carrying out the slit of the continuous-glass-fiber nonwoven fabric of latus width of face to band-like more preferably. Although the main reasons made band-like are also for raising the performance of a filter itself so that it may mention later, they also have another reason. I hear that width of face loses substantially the spots of a latus (for example, more than [500mm width of face]) continuous-glass-fiber nonwoven fabric, and it has it. Although the span bond method is common as point ** was carried out as a method of making a continuous-glass-fiber nonwoven fabric, since the span bond method is a method of distributing fiber by attracting and extending the fiber breathed out from the nozzle in air soccer etc., and throwing to a uptake conveyer, spots tend to be made to a nonwoven fabric. Nonwoven fabric spots occur by eyes of the nonwoven fabric cross direction, spots of the diameter of fiber, etc. by the resin lump furthermore generated by the thread breakage at the time of spinning, and regurgitation spots. According to a manufacturing method, although it is various, just the cause to generate generates such nonwoven fabric spots, even if it uses manufacturing methods other than the span bond method. Although the device of being as making full use of advanced spinning technology **** [, and] is made in order to lose the spots of such a nonwoven fabric, any method will have bad influence on a price or productivity. [removing a poor part physically from a product generally]

[0036] Then, although this invention persons study the property of the nonwoven fabric of many including a continuous-glass-fiber nonwoven fabric, consequently it was easy to generate the spots of a nonwoven fabric in the machine cross direction, the comparatively few thing was found out to the flow direction of a nonwoven fabric. This invention persons will have noticed the point of becoming so small that nonwoven fabric spots being disregarded, among the width of face of the band of each, if the result was considered further and width of face cut the latus nonwoven fabric in band-like [of 0.5cm - about several centimeters]. Since it is possible to change a filtration efficiency also by the forming method of a filtering medium if the method of this invention mentioned later is used, if the molding method is adjusted for every physical properties of a band-like nonwoven fabric, most performance spots of the made filter are lost. Thereby, the extensive improvement of productivity or a material unit is expectable.
[0037] Although the width of face in the case of carrying out the slit of the continuous-glass-fiber nonwoven fabric of latus width of face, and considering as a band-like continuous-glass-fiber nonwoven fabric changes also with eyes of the nonwoven fabric to be used, its 0.5cm or more is desirable. In adjustment of the tension at the time of there being a possibility that a nonwoven fabric may cut that this width of face is less than 0.5cm at the time of a slit, and rolling round a band-like nonwoven fabric in the shape of Aya behind becoming difficult and making the filter of the same voidage, it rolls round, time becomes long and productivity falls. On the other hand, the upper limit of width of face changes with eyes, and it is desirable that the value of (width-of-face cm) x eyes (g/m2) is 200 or less. For example, at the time of eyes 20 g/m2, an upper limit is 10cm. Since it is hard coming to twist around a perforated tube-like object in the shape of Aya behind since the rigidity of a nonwoven fabric will become large too much, if this value exceeds 200, and the amount of fiber increases too much further, twisting densely becomes difficult. In addition, when adjusting spinning width of face and making a direct band-like nonwoven fabric, the range of desirable eyes and nonwoven fabric width of face is the same as the case where carry out a slit and it is made band-like.
[0038] Although it may be twisted around the second filter layer (the detail about the second filter layer is mentioned later) in the shape of Aya after processing suitably the aforementioned band-like continuous-glass-fiber nonwoven fabric by method which is mentioned later, you may twist as it is, without processing it. An example of the manufacturing method in this case is shown in drawing 4 . The winder used for the usual spool type filter cartridge can be used for a winder. the narrow width which moves while the supplied band-like continuous-glass-fiber nonwoven fabric 9 reciprocates -- after passing along the traverse guide 10 of a hole, it is rolled round by the second filter layer 2 attached in the bobbin 11, and becomes a filter cartridge 12 Since the filter cartridge made by this method becomes very dense, it turns into a filter cartridge with a fine precision. However, it is difficult to change manufacture conditions by this method and to adjust a filtration accuracy.
[0039] On the other hand, after adding a twist to a band-like continuous-glass-fiber nonwoven fabric, it can also roll round. An example of the manufacturing method in this case is shown in drawing 5 . Also in this case, the winder used for the usual spool type filter cartridge can be used for a winder. Since a nonwoven fabric becomes thick seemingly by the twist, a traverse guide 13 has the big thing of an aperture more desirable than the case of drawing 4 . If a twist is added to a nonwoven fabric, since the voidage of the appearance of a nonwoven fabric can be changed by the number of the twists per unit length, or the strength to twist, a filtration accuracy can be adjusted. The number of the twists at this time has 50 - 1000 times per 1m of band-like continuous-glass-fiber nonwoven fabrics of desirable ranges. The effect of adding a twist as this value is less than 50 times is hardly acquired. Moreover, if this value exceeds 1000 times, since the made filter cartridge will become coarse at dipping nature, it is not desirable.
[0040] Moreover, it is still more desirable, when it is twisted around a perforated tube-like object, since the aforementioned band-like continuous-glass-fiber nonwoven fabric is converged by the suitable method. As the method, a band-like continuous-glass-fiber nonwoven fabric may be converged through an only suitable stoma etc., and after preforming a cross-section configuration in a suitable plication guide, you may process a band-like continuous-glass-fiber nonwoven fabric into a rib-like object through a stoma etc. If this method is used, since the ratio of the reciprocating-movement speed of a

traverse guide and the rotational speed of a bobbin is adjusted and a volume pattern can be changed, the filter cartridge of various performances can be made from the band-like continuous-glass-fiber nonwoven fabric of the same kind.

[0041] An example of the manufacturing method in the case of letting a stoma only suitable as the method of converging a band-like continuous-glass-fiber nonwoven fabric pass is shown in drawing 6 . Also in this case, the winder used for the usual spool type filter cartridge can be used for a winder. Although the band-like continuous-glass-fiber nonwoven fabric is converged by making the hole of a traverse guide 14 into a stoma in drawing 6 , you may prepare the guide of a stoma in a front thread guide rather than a traverse guide 14. Although the diameter of a stoma is based also on the eyes and width of face of a band-like continuous-glass-fiber nonwoven fabric to be used, its range of 3mm - 10mm is desirable. Friction with a band-like continuous-glass-fiber nonwoven fabric and a stoma becomes it large that this diameter is less than 3mm, it rolls round, and tension becomes high too much. When this value exceeds 10mm, the convergence size of a band-like continuous-glass-fiber nonwoven fabric stops moreover, stabilizing.

[0042] next, a part of example of the manufacturing method in the case of processing a band-like continuous-glass-fiber nonwoven fabric into a rib-like object through a stoma etc., after preforming a cross-section configuration in a suitable plication guide -- a notching perspective diagram is shown in drawing 7 Also in this case, the winder used for the usual spool type filter cartridge can be used for a winder. When taking this method, preforming of the cross-section configuration is carried out through the plication guide 19, the band-like continuous-glass-fiber nonwoven fabric 9 serves as the rib-like object 18 through a stoma 17 continuously, and if the rib-like object 18 is taken over in the direction of A of drawing and it rolls round to the second filter layer through a traverse guide, it will serve as a filter cartridge.

[0043] Next, the aforementioned plication guide ****** explanation is given. Although the plication guide usually processed the round bar with an outer diameter of 3mm - about 10mm, it gives and makes fluororesin processing for preventing friction with a nonwoven fabric on a front face. One example of the configuration is shown in drawing 8 -9. The plication guide 19 consists of an external regulation guide 15 and an internal regulation guide 16 in the example given here. Although not limited, if especially the configuration of this plication guide 19 is a form which becomes what converged so that the cross-section configuration of the rib-like object made from this guide might not become parallel [a rib], it is desirable. Although one example of the cross-section configuration of the rib-like object made by making it such is shown in drawing 10 (A), (B), and (C), it is not limited to these. In these modes of this invention, the thing in which the rib-like object which converged so that a part of rib [at least] might be un-parallel was made to form is the most desirable mode of this invention. That is, when a part of rib is un-parallel like the cross-section configuration of drawing 10 , as shown in drawing 11 (A) and (B), even when filtration pressure is applied to a rib from a perpendicular direction like an arrow compared with the case where most ribs are parallel, the configuration holding power of a rib-like object is strong, and the filtration function as an original rib configuration can be held. That is, since it excels in the capacity to suppress the pressure loss of a filter cartridge as compared with the case where a rib is parallel when a rib is not parallel, the cross-section configuration of a rib-like object of especially the thing a rib is not [a thing] parallel is desirable. In addition, it does not necessarily need to be one, and if the cross-section configuration of a band-like continuous-glass-fiber nonwoven fabric is gradually changed by putting in order in series some guides from which a form and a size differ, since the cross-section configuration of a rib-like object becomes fixed by the place, the nonuniformity of quality of a guide is lost and it is desirable.

[0044] In this invention, after using a band-like continuous-glass-fiber nonwoven fabric as a rib-like object, when twisting around the second filter layer, the 4-50 final numbers of ribs of a rib-like object are 7-45 pieces more preferably. The number of ribs is deficient in the effect by the filtration area expansion by rib grant in less than four pieces. On the other hand, if the number of ribs exceeds 50 pieces, a rib becomes small too much, and manufacture will be difficult and it will become easy to produce the influence on a filtration depression.

[0045] moreover -- for example, the narrower rectangle after giving many ribs to a continuous-glass-fiber nonwoven fabric using the plication guide 20 of Kushigata as shown in drawing 12 -- it is made to deform so that many numbers of ribs may become further by passing a hole 21, and random in a rib -- suppose that it is un-parallel
[0046] Moreover, the cross-section configuration of a rib-like object is fixable by carrying out heating processing of the rib-like object 18 after letting the stoma 17 which carried out point ** pass at hot blast or an infrared heater. Although this process is not necessarily required, since it may collapse from the form which the cross-section configuration designed when the cross-section configuration of a rib-like object is complicated or rigidity uses a high thing as a band-like continuous-glass-fiber nonwoven fabric, it is desirable to carry out such heating processing.
[0047] Next, the voidage of the band-like continuous-glass-fiber nonwoven fabric which is used by this invention and which converged, or a rib-like object (hereafter, it unites and abbreviates to a band-like continuous-glass-fiber nonwoven fabric convergence object) is explained. first, the ovoid of the minimum area to which the cross section of a band-like continuous-glass-fiber nonwoven fabric convergence object connotes the band-like continuous-glass-fiber nonwoven fabric convergence object 4 as shown in drawing 13 -- it is defined as the area of 22 (an ovoid means the polygon each of each of that interior angle of whose is less than 180 degrees altogether) And a band-like continuous-glass-fiber nonwoven fabric convergence object is cut to suitable length (a square root 100 times the length [for example,] of the cross section), and it defines by the following formula.
[0048] (Appearance volume of a band-like continuous-glass-fiber nonwoven fabric convergence object) = (cutting length of the cross-section x band-like continuous-glass-fiber nonwoven fabric convergence object of a band-like continuous-glass-fiber nonwoven fabric convergence object)
[0049] (Block style product of a band-like continuous-glass-fiber nonwoven fabric convergence object) =(weight of cut band-like continuous-glass-fiber nonwoven fabric convergence object)/(specific gravity of the raw material of a band-like continuous-glass-fiber nonwoven fabric convergence object)
[0050] (Voidage of a band-like continuous-glass-fiber nonwoven fabric convergence object) ={1-(block style product of band-like continuous-glass-fiber nonwoven fabric convergence object)/(appearance volume of band-like continuous-glass-fiber nonwoven fabric convergence object)} x100%[0051] 60 - 95% of the voidage of the band-like continuous-glass-fiber nonwoven fabric convergence object defined by this formula is desirable, and it is 85 - 92% more preferably. By making this value into 60% or more, a band-like continuous-glass-fiber nonwoven fabric convergence object can stop a bird clapper more densely than required, and the pressure loss when using it as a filter cartridge can be suppressed enough, or the foreign matter collection efficiency in a band-like continuous-glass-fiber nonwoven fabric convergence object can be raised more. Moreover, by making this value into 95% or less, when it is used as a next injury easy next door with a volume, and a filter cartridge, deformation of the filtering medium by the load pressure can be made smaller. As an example of the method of adjusting this, adjustment of guide configurations, such as adjustment of rolling-up tension and a plication guide, is mentioned.
[0052] Moreover, it is a book when making a band-like continuous-glass-fiber nonwoven fabric convergence object. In this case, in order to fix a granular active carbon, ion exchange resin, etc., before processing a band-like continuous-glass-fiber nonwoven fabric into convergence or a rib-like object, or after processing it, it may paste up with a suitable binder etc., after making a granular active carbon, ion exchange resin, etc. intermingled, it may heat, and you may carry out heat adhesion with the composition fiber of a continuous-glass-fiber nonwoven fabric.
[0053] next -- if the band-like continuous-glass-fiber nonwoven fabric convergence object made by the method which carried out point ** devises so that a cross-section configuration may not collapse -- not necessarily -- a continuous process -- it is not necessary to carry out -- ****** -- it winds around the suitable bobbin and you may roll round by the winder behind
[0054] Next, how to roll round a band-like continuous-glass-fiber nonwoven fabric is explained. The bobbin of this winder is equipped with the second filter layer with a diameter [of about 10-40mm], and a length of about 100-1000mm, and the band-like continuous-glass-fiber nonwoven fabric (or band-like

continuous-glass-fiber nonwoven fabric convergence object) which let the thread guide of a winder pass at the edge of a perforated tube-like object is fixed. Since the thread guide of a winder is shaken in the shape of Aya by the traverse cam installed in parallel with a bobbin, a band-like continuous-glass-fiber nonwoven fabric is shaken at the second filter layer in the shape of Aya, and it is twisted around it. What is necessary is just to twist, making it the bobbin initial velocity 1000 - 2000rpm, adjusting delivery speed that what is necessary is just to also set up the winding conditions at that time according to the time of the usual spool type filter-cartridge manufacture, and applying suitable tension. In addition, the voidage of a filter cartridge is changeable with the tension at this time. Voidage can be made coarse as it furthermore twists, and the tension at the time is adjusted, voidage of a inner layer is made dense and it twists with a middle lamella and an outer layer. After using especially a band-like continuous-glass-fiber nonwoven fabric as a rib-like object, when twisting around the second filter layer, the filter cartridge which has ideal filtration structure according to the of-condensation-and-rarefaction structure difference which combines with the depth-type-filtration structure by the plication which a rib-like object possesses, and is formed by the outer layer in the first filter layer, the middle lamella, and the inner layer can be offered. Moreover, a filtration accuracy can be changed also by adjusting and twisting the ratio of the reciprocating-movement speed of a traverse cam, and the rotational speed of a bobbin, and changing a pattern. How to attach the pattern can already use the method of the well-known usual spool type filter cartridge, and when the length of a filter is fixed, it can express the pattern with the number of winds. In addition, the interval 26 of a certain thread (in the case of this invention, it is a band-like continuous-glass-fiber nonwoven fabric) and the thread wound around the layer under one of them becomes coarse at a latus case, and a filtration accuracy becomes fine when conversely narrow. A band-like continuous-glass-fiber nonwoven fabric is twisted by these methods to an about 3 times [of the bore of the second filter layer 2 / 1.5 times to] outer diameter, and it is made a filter-cartridge configuration. This may be used as a filter cartridge 3 as it is, the gasket of polyethylene foam with a thickness of about 3mm may be stuck on an end face, and adhesion with housing of a filter-cartridge end face may be raised.

[0055] Thus, as for the voidage of the first made filter layer, it is desirable that it is 65 - 85% of range. Since fiber density becomes it high that this value is less than 65% too much, dipping nature falls. On the contrary, if this value exceeds 85%, filter-cartridge intensity falls, and when filtration pressure is high, it will become easy to produce the problem of a filter cartridge deforming.

[0056] In this invention, the dipping nature of the cartridge filter obtained is improvable by putting a break into a band-like continuous-glass-fiber nonwoven fabric, or making a hole in it. In this case, about 5-100 pieces are suitable for it per 10cm of band-like continuous-glass-fiber nonwoven fabrics, and when making a hole, it is appropriate for the number of breaks to make the rate of a puncturing aspect product about 10 - 80%. It can consider as plurality or combining the number of the band-like continuous-glass-fiber nonwoven fabric when rolling round with other thread, such as spun yarn, and twining it can also adjust a filtration efficiency.

[0057] Next, the second filter layer used by this invention is explained.

[0058] since the filter of a double layer made from the Prior art had a problem in the layer (layer equivalent to the first filter layer of this invention) of the upstream, it was what a problem is in precision stability or a filtration life, or the foreign matter of a filtering-medium defluxion object and others mixes into filtrate Although the second filter layer is fundamentally satisfactory if it is a filter highly precise than the first filter layer since those problems are solved with devising the first filter layer as point ** was carried out in this invention, it is desirable that it is the range whose initial 80% uptake particle size of the second filter layer is 0.05 to 0.9 times the initial 80% uptake particle size of the first filter layer. Since a difference is impudent in the uptake capacity of the first filter layer and the second filter layer in this value being less than 0.05, almost all particles are not caught by the first filter layer but blinding may happen on the front face of the second filter layer, it is not desirable. On the contrary, if this value exceeds 0.9 times, since there is no difference in the uptake capacity of the first filter layer and the second filter layer too much, the meaning divided into two or more layers will almost be lost. In addition, since the optimum value of this value is based on the particle size distribution in front [filtration] liquid, it can be said generally that yes, it is desirable to enlarge this value when the particle

to which the size gathered comparatively in front [filtration] liquid preferably [making this value small, when the particle of various sizes is generally contained in front / filtration / liquid], and conversely is contained, although not obtained. Hereafter, the example of a filter layer useful as the second filter layer is given.

[0059] As one of the things useful as the second filter layer, what wound the perforated sheet around the surroundings of a perforated tube-like object in the shape of a sushi roll with seaweed can be used. As a perforated sheet, a nonwoven fabric, textile fabrics, a membrane sheet, a filter paper, a wire gauze, etc. are mentioned. The structure of this filter is shown in drawing 16 . Although the perforated plastics core which injection molded, metalworking articles, such as stainless steel, etc. can be used for the perforated tube-like object 26, it will not be limited especially if it has the intensity of the grade which can bear filtration pressure. If the perforated sheet 27 is wound in the shape of a sushi roll with seaweed, the aforementioned initial 80% uptake particle size can be attained and a well-known method, for example, a melt blow nonwoven fabric, will be used for the determination of the eyes of the nonwoven fabric, the diameter of fiber, etc. satisfactory, it can apply the method indicated by JP,10-174822,A. Moreover, if a direct perforation sheet is wound around a perforated tube-like object, since the surface area of a perforated sheet will become small, it is good for the surroundings of a perforated tube-like object also as a three-tiered structure which prepared the third filter layer of the structure same in a size about 5 to 20% as the first filter layer of the outer diameter of the whole filter cartridge. Moreover, it is also good that the man day will fabricate the nonwoven fabric to tubed beforehand, and will put it on a core depending on the manufacture method for this reason if it winds in the shape of a sushi roll with seaweed. Moreover, a book

[0060] As one of what [the / useful] has second another filter layer, there is a thing of structure as shown in drawing 17 . That is, the thing of the two-layer structure which consists of a filter layer 28 which twisted around the cylindrical shape the band-like continuous-glass-fiber nonwoven fabric which consisted of thermoplastic fiber and a part of the fiber intersection [at least] has pasted up on the surroundings of the perforated tube-like object 26 in the shape of Aya, and a filter layer 29 continuously twisted around the cylindrical shape in the shape of Aya in the band-like continuous-glass-fiber nonwoven fabric from the filter layer 28 while involving in the perforated sheet 27 in the shape of a sushi roll with seaweed can be used. Although this filter resembles apparently the filter shown in drawing 16 which carried out point **, as for the filter layer 29 which is a part of second filter layer of the filter of drawing 17 , the second filter layer 27 of drawing 16 has difference that the band-like continuous-glass-fiber nonwoven fabric which carried out the wind has entered between a perforated sheet and a perforated sheet for the process, to only the perforated sheet being rolled.

[0061] What bent the perforated sheet in the shape of a pleat around the perforated tube-like object, and was fabricated by tubed as one of what [the / useful] has second another filter layer is mentioned. The structure of this filter is shown in drawing 18 . As a perforated sheet, a nonwoven fabric, textile fabrics, a membrane sheet, a filter paper, a wire gauze, etc. are mentioned similarly. A well-known method, for example, the method indicated by JP,6-262013,A, can be used for processing of these perforation sheet. Since the surface area of a filtering medium is large when this is used, it becomes the filter excellent in water flow nature.

[0062] The tubed Plastic solid which consisted of a heat adhesive property bicomponent fiber which consists of two sorts of thermoplastics of 10 degrees C or more of melting point differences as one of what [the / useful] has second another filter layer, and the intersection of a heat adhesive property bicomponent fiber pasted up is mentioned. The structure of this filter is shown in drawing 19 . Since the fiber intersection of the second filter layer 31 has pasted up when this filtering medium is used, even if filtration pressure is improved, it becomes what has that few the particle by which the uptake was carried out flows out excellent. The forming method of this tubed Plastic solid can use the method indicated by a well-known method, for example, JP,56-43139,B, and JP,4-126508,A.

[0063]

[Example] Below, although this invention is explained still in detail, this invention is not limited to these examples by an example and the example of comparison. In addition, evaluation of the physical

properties of a filter medium, a filtration efficiency, etc. in each example was performed by the method of indicating below. Moreover, the evaluation result was shown in Tables 1 and 2.
[0064] (The eyes and thickness of a nonwoven fabric) The nonwoven fabric was cut off so that the area of a nonwoven fabric might be set to 2 625cm, the weight was measured, and it converted into the weight per square meter, and considered as eyes. Moreover, ten thickness of the cut-off nonwoven fabric was measured arbitrarily, and the average of eight points except the maximum and minimum value was made into the thickness (micrometer) of a nonwoven fabric.
[0065] (Fineness of a nonwoven fabric) Five places were sampled at random from the nonwoven fabric, they were photoed with the scanning electron microscope, 20 fiber per place was chosen at random, those diameters of fiber were measured, and the average was made into the diameter (micrometer) of fiber of the nonwoven fabric. Moreover, it asked for fineness (dtex) from the following formula using the density (g/cubic centimeter) of the obtained diameter of fiber, and the charge resin of nonwoven Nunohara.
(Fineness) =pi(diameter of fiber) 2x (density)/400 [0066] After fixing the cross-section configuration of a rib-like object with adhesives, five places were cut in arbitrary positions and a photograph of the cross section was taken under the microscope. From the photograph, in any [of a mountain chip box or a valley chip box] case, the number of the folds of a band-like continuous-glass-fiber nonwoven fabric was counted as one, and 1/2 of the cut number of averages of five places was made into the number of ribs.
[0067] (The cross section and voidage of a band-like continuous-glass-fiber nonwoven fabric convergence object) After fixing the cross-section configuration of a band-like continuous-glass-fiber nonwoven fabric convergence object with adhesives, five places were cut in arbitrary positions and a photograph of the cross section was taken under the microscope. Image analysis of the photograph was carried out, and it asked for the cross section of a band-like continuous-glass-fiber nonwoven fabric convergence object. Moreover, the band-like continuous-glass-fiber nonwoven fabric convergence object of a part different from this was cut in length of 10cm, and it asked for voidage using the following formula from the weight and the cross section for which it asked previously.
(Appearance volume of a band-like continuous-glass-fiber nonwoven fabric convergence object) = (cutting length of the cross-section x band-like continuous-glass-fiber nonwoven fabric convergence object of a band-like continuous-glass-fiber nonwoven fabric convergence object)
(Block style product of a band-like continuous-glass-fiber nonwoven fabric convergence object) = (weight of band-like continuous-glass-fiber nonwoven fabric convergence object)/(specific gravity of the raw material of a band-like continuous-glass-fiber nonwoven fabric convergence object)
(Voidage of a band-like continuous-glass-fiber nonwoven fabric convergence object) ={1-(block style product of band-like continuous-glass-fiber nonwoven fabric convergence object)/(appearance volume of band-like continuous-glass-fiber nonwoven fabric convergence object)} x100%[0068] (Thread interval) Ten intervals per filter cartridge (shown in 32 of drawing 1) with the band-like continuous-glass-fiber nonwoven fabric convergence object contiguous to the band-like continuous-glass-fiber nonwoven fabric convergence object (or thing twisted around the perforated tube-like object in the example of the followings, such as a band-like continuous-glass-fiber nonwoven fabric and spun yarn) in a surface were measured, and the average was made into the thread interval.
[0069] (Voidage of the first filter layer) The outer diameter of the first filter layer, a bore, length, and the weight were measured, and it asked for voidage using the following formula. In addition, the weight took out and measured only the first filter layer from the filter made as an experiment on these conditions.
(Appearance volume of the first filter layer) =pi {(outer diameter of the first filter layer)2-(bore of first filter layer) 2} x(length of first filter layer) /4(block style product of first filter layer) =(weight of first filter layer)/(specific gravity of the raw material of the first filter layer)
(Voidage of the first filter layer) = {appearance volume of 1- (block style product of first filter layer) / first filter layer} x100%[0070] (Initial uptake particle size, initial-pressure loss, filtration life) One filter cartridge is attached in housing of a circulating filtration-efficiency testing machine, with a pump, a flow

rate is adjusted to 30l./m, and water flow circulation is carried out. Pressure loss before and behind the filter cartridge at this time was considered as initial-pressure loss. Next, eight sorts of the test powder I set to the water through which it circulates JIS 8901 (it abbreviates to eight sorts of JIS.) Z Median diameter: They are said 7 kinds (it abbreviates to seven sorts of JIS.) as 6.6-8.6 micrometers. Median diameter: Continuation addition of the cake which mixed 27-31 micrometers by the weight ratio 1:1 was carried out by part for 0.4g/m/, the liquid before filtration and filtrate were extracted after [of an addition start] 5 minutes, and after diluting with a suitable scale factor, the initial collection efficiency in each particle size was computed by having measured the number of the particles contained in each liquid by the optical interception formula particle detector. Furthermore the value was interpolated and it asked for the particle size which shows 80% of collection efficiencies. Furthermore, the cake was added continuously, when the pressure loss of a filter cartridge reached 0.2MPa(s), the liquid before filtration and filtrate were extracted similarly, and it asked for the uptake particle size at the time of 0.2MPa. Moreover, time until it reaches 0.2MPa(s) from a cake addition start was made into the filtration life. In addition, even if the filtration life reached in 1000 minutes, when differential pressure did not reach 0.2MPa(s), measurement was interrupted at the time. As point ** was carried out, inside used the perforated plastics cast of a cavity as a dummy, and the initial 80% uptake particle size of each class made only each layer from these conditions, and measured it.

[0071] (Foaming of initial filtrate, and fiber defluxion) One filter cartridge is attached in housing of a circulating filtration-efficiency testing machine, a flow rate is adjusted to 10l./m with a pump, and it lets ion exchange water flow. 1l. of initial filtrate was extracted, 25 cubic centimeters was extracted into the colorimetry bottle among those, it stirred violently, and foaming was seen after [of a stirring halt] 10 seconds. And 10 cubic centimeters or more of volume of a bubble (volume from an oil level to the peak of a bubble) were x and less than 10 cubic centimeters about a certain case, and foaming was judged, having used as O the case where ** and a bubble with a diameter of 1mm or more were less than five pieces about the case where five or more bubbles with a diameter of 1mm or more are seen. Moreover, four or more fiber more than the filter mm indicated by the nitrocellulose filter paper of 0.8 micrometers of apertures to length 1 in 500 cubic centimeters of initial filtrate per through and 1 square centimeter of filter papers made [a certain case] ** and zero case O for x and 1-3 cases, and fiber defluxion was judged.

[0072] (Example 1) What wound the melt blow nonwoven fabric made from polypropylene of 300 micrometers in eyes 50 g/m2 and thickness and 2 micrometers of diameters of fiber around the surroundings of the perforated tube-like object which is 250mm in the bore of 30mm, the outer diameter of 34mm, and length, and is the injection molding article made from polypropylene which 180 holes of 6mm angle have opened as the second filter layer in the shape of a sushi roll with seaweed 1.1 round was used. Moreover, as a continuous-glass-fiber nonwoven fabric for band-like continuous-glass-fiber nonwoven fabrics, it is 200 micrometers in eyes 22 g/m2 and thickness, and fineness 2dtex, and the span bond nonwoven fabric made from polypropylene to which thermocompression bonding of the fiber intersection was carried out by the heat embossing roll was used. The slit of the continuous-glass-fiber nonwoven fabric was carried out to width of face of 50mm, and it considered as the band-like continuous-glass-fiber nonwoven fabric. and the bobbin of a winder -- the second filter layer -- installing -- the thread guide to a winder -- the diameter of 5mm -- circular -- the guide of a hole is installed and the band-like continuous-glass-fiber nonwoven fabric was converged on the diameter of about 5mm, it rolled round until it adjusted the number of winds and became the outer diameter of 62mm to the perforated tube-like object so that the interval of a band-like continuous-glass-fiber nonwoven fabric might be set to 1mm by spindle initial velocity 1500rpm at the second filter layer, and the cylinder-like filter cartridge 3

[0073] (Example 2) The slit of the continuous-glass-fiber nonwoven fabric was carried out to width of face of 10mm, the number of winds was adjusted so that a thread interval might be further set to 1mm, and also [all] it is the same method as an example 1, and the cylinder-like filter cartridge was obtained. This filter turned into a filter of a performance of the same grade as an example 1. However, the time which rolling up took became longer than the time of an example 1.

[0074] (Example 3) as the composition fiber of a continuous-glass-fiber nonwoven fabric -- a low melting point component -- a line -- the low density polyethylene (melting point : 125 degrees C) and the high-melting point component used with polypropylene the **** type bicomponent fiber which is the weight ratio 5:5, and also [all] it is the same method as an example 1, and the cylinder-like filter cartridge was obtained This filter turned into a filter with a filtration life longer than the filter indicated by the example 1. Since the fiber intersection of the first filter layer has pasted up firmly, the uptake capacity of the first filter layer is stabilized by this, and it is considered because the burden concerning the second filter layer decreased.
[0075] (Example 4) The heat adhesion method of a fiber intersection was changed into hot blast circulating heating apparatus from the heat embossing roll, and also [all] it is the same method as an example 3, and the cylinder-like filter cartridge was obtained. This filter turned into a filter with mist and a filtration life shorter than the filter indicated by the example 3. As for this, adhesion of the fiber intersection of the first filter layer is considered because it was not firm in the about three example.
[0076] (Example 5) The fineness of a continuous-glass-fiber nonwoven fabric was changed into 10dtex (es), and also [all] it is the same method as an example 1, and the cylinder-like filter cartridge was obtained. This filter turned into a filter with a filtration life shorter than the filter indicated by the example 1.
[0077] (Example 6) Did not converge a band-like continuous-glass-fiber nonwoven fabric, 100 times per m of twists were added instead, and also [all] it is the same method as an example 1, and the cylinder-like filter cartridge was obtained. This filter turned into a filter indicated by the example 1 and a filter of a performance of the same grade.
[0078] (Example 7) The cross-section configuration as shows a band-like continuous-glass-fiber nonwoven fabric to drawing 10 (A) was processed, and the rib-like object with four ribs was obtained. The rib-like object was used instead of the band-like continuous-glass-fiber nonwoven fabric which converged, and also [all] it is the same method as an example 1, and the cylinder-like filter cartridge was obtained. Pressure loss became large although this filter turned into a filter with a little long filtration life from the filter indicated by the example 1. Since the rib of a rib-like object was parallel, as compared with the filter indicated by the example 1, pressure loss became large, because filtration pressure was applied from the direction perpendicular to a rib and the voidage of a filtering medium became small.
[0079] (Example 8) The cross-section configuration as shows a band-like continuous-glass-fiber nonwoven fabric to drawing 10 (A) was processed, and the rib-like object with seven ribs was obtained. The rib-like object was used, and also [all] it is the same method as an example 7, and the cylinder-like filter cartridge was obtained. Although this filter was a filter with a life longer than the filter indicated by the example 1, water flow nature became the filter indicated by the example 1 and the equivalent outstanding filter.
[0080] (Example 9) The cross-section configuration as shows a band-like continuous-glass-fiber nonwoven fabric to drawing 10 (C) was processed, and the rib-like object with 15 ribs was obtained. The rib-like object was used, and also [all] it is the same method as an example 7, and the cylinder-like filter cartridge was obtained. It became the filter with which water flow nature was indicated by the example 1 rather than the filter with which this filter was indicated by the example 8 in spite of having been a filter with a still longer life, and the equivalent outstanding filter.
[0081] (Example 10) The number of ribs of a band-like continuous-glass-fiber nonwoven fabric was set to 41, and also [all] it is the same method as an example 9, and the cylinder-like filter cartridge was obtained. It became the filter with which water flow nature was indicated by the example 1 rather than the filter with which this filter was indicated by the example 9 in spite of having been a filter with a still longer life, and the equivalent outstanding filter.
[0082] (Example 11) Converged densely the band-like continuous-glass-fiber nonwoven fabric, and voidage of a rib-like object was made 72%, and also [all] it is the same method as an example 9, and the cylinder-like filter cartridge was obtained. This filter turned into a filter with a life shorter than an example 9.

[0083] (Example 12) As a nonwoven fabric for involving in, the same melt blow nonwoven fabric as an example 1 was used. The band-like continuous-glass-fiber nonwoven fabric also used the same thing as an example 1. And the band-like continuous-glass-fiber nonwoven fabric was twisted around the surroundings of the same perforated tube-like object as an example 1 in the shape of Aya until an example 1 and these conditions made an outer diameter of 45mm. Then, while twisting the band-like continuous-glass-fiber nonwoven fabric in the shape of Aya continuously, the nonwoven fabric for involving in was twisted 1.1 round in the shape of a sushi roll with seaweed. Furthermore, continuously, only the band-like continuous-glass-fiber nonwoven fabric was twisted until it became Aya-like the outer diameter of 62mm, and the cylinder-like filter cartridge was obtained. Although this filter turned into a filter of a precision of the same grade as an example 1, it became what is excellent in water flow nature a little. Since the sushi-roll-with-seaweed-like nonwoven fabric came to the periphery side rather than the example 1, this is considered because nonwoven face area went up.
[0084] (Example 13) The melt blow nonwoven fabric made from polypropylene compressed by 1 micrometer of diameters of fiber and eyes 30 g/m2 until it became 50% of voidage with a flat roll was prepared. The span bond nonwoven fabric made from polypropylene of fineness 2dtex was laid on top of the both sides of the melt blow nonwoven fabric by eyes 22 g/m2, and rib chip box processing was carried out in 8mm of mountain quantities, it cut by threads per inch 75, ends were connected, and it was made tubed, and it has arranged around the same perforated tube-like object as an example 1, and considered as the second filter layer. The first filter layer was made by the method as an example 1 that it is the same around it, and the cylinder-like filter cartridge as shown in drawing 18 was obtained.
[0085] (Example 14) It was 64mm in fineness 2dtex and fiber length, and the **** type bicomponent fiber which consists of a high density polyethylene and polypropylene was used as the web by the carding machine, it twisted until it heated at 145 degrees C at the far-infrared heater and became the outer diameter of 45mm on the 1.5kg [per m] mandril made from Indanthrene loess, and the mandril after cooling was sampled, and the hollow tube-like object was obtained. The hollow tube-like object was used as the second filter layer, and also the cylinder-like filter cartridge was obtained by the same method as an example 1.
[0086] (Example 1 of comparison) Used the spun yarn made from polypropylene with a diameter of 2mm which spinned the fiber of fineness 3dtex instead of the band-like continuous-glass-fiber nonwoven fabric, and the thread interval was set to 1mm, and also [all / and also] the cylinder-like filter cartridge was obtained by the same method as an example 1. As for this filter cartridge, the filtration life became quite shorter than an example 1. Moreover, there was foaming in initial filtrate.
[0087] (Example 2 of comparison) JIS cut in width of face of 50mm instead of the band-like continuous-glass-fiber nonwoven fabric P One sort of filter papers set to 3801 were used, and also [all / and also] the cylinder-like filter cartridge was obtained by the same method as an example 1. Although this filter cartridge had an initial uptake particle size of the same grade as the example 1, initial-pressure loss was large and the filtration life was extremely short.
[0088] (Example 3 of comparison) The slit of the continuous-glass-fiber nonwoven fabric of eyes 50 g/m2 was carried out to 25cm width of face by fineness 5dtex, it twisted around the surroundings of the second same filter layer as an example 1 by linear pressure 1.5 kg/m in the shape of a sushi roll with seaweed, and the cylinder-like filter cartridge was obtained. Although the initial uptake particle size of this filter was of the same grade as the example 1, water flow nature was bad and the filtration life was short.
[0089]
[Table 1]

	第一濾過層に使用される長繊維不織布						不織布の加工		
	目付 (g/m^2)	厚さ (μm)	繊度 (dtex)	交点接着	樹脂	スリット幅 (mm)	断面形状	ひだ数	空隙率 (%)
実施例1	22	200	2	エンボス	PP	50	集束	−	90
実施例2	22	200	2	エンボス	PP	10	集束	−	90
実施例3	22	200	2	エンボス	LLDPE/PP	50	集束	−	90
実施例4	22	200	2	TA	LLDPE/PP	50	集束	−	90
実施例5	22	200	10	エンボス	PP	50	集束	−	90
実施例6	22	200	2	エンボス	PP	50	ひねり	−	−
実施例7	22	200	2	エンボス	PP	50	図10−(A)	4	90
実施例8	22	200	2	エンボス	PP	50	図10−(A)	7	95
実施例9	22	200	2	エンボス	PP	50	図10−(C)	15	90
実施例10	22	200	2	エンボス	PP	50	図10−(C)	41	91
実施例11	22	200	2	エンボス	PP	50	図10−(C)	15	72
実施例12	22	200	2	エンボス	PP	50	集束	−	90
実施例13	22	200	2	エンボス	PP	50	集束	−	90
実施例14	22	200	2	エンボス	PP	60	集束	−	90
比較例1	(PP紡績糸使用)				PP		(PP紡績糸使用)		
比較例2	90	200	−	(濾紙1種)	セルロース	15	なし	−	−
比較例3	22	200	2	エンボス	PP	(250)	なし	−	−

[0090]
[Table 2]

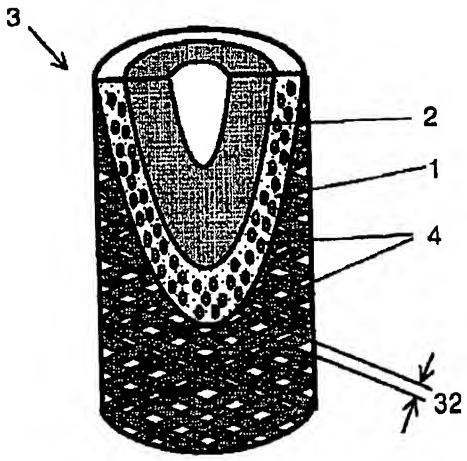
	巻き上げ		第一濾過層	第二濾過層		フィルター濾過性能					
	糸間隔 (mm)	フィルター空隙率 (%)	初期捕集粒径 (μm)	形態	初期捕集粒径 (μm)	初期捕集粒径 (μm)	初期圧力損失 (MPa)	0.2MPa時捕集粒径 (μm)	濾過ライフ (分)	泡立ち	繊維脱落
実施例1	1	82	13	のり巻き	5	5	0.003	5	20	○	○
実施例2	1	81	12	のり巻き	5	5	0.003	5	20	○	○
実施例3	1	81	12	のり巻き	5	5	0.003	5	30	○	○
実施例4	1	82	13	のり巻き	5	5	0.003	5	25	○	○
実施例5	1	83	30	のり巻き	5	5	0.003	5	15	○	○
実施例6	1	81	13	のり巻き	5	5	0.003	5	20	○	○
実施例7	1	82	11	のり巻き	5	5	0.004	5	20	○	○
実施例8	1	82	11	のり巻き	5	5	0.003	5	25	○	○
実施例9	1	82	10.5	のり巻き	5	5	0.003	5	27	○	○
実施例10	1	82	10.0	のり巻き	5	5	0.003	5	30	○	○
実施例11	1	83	30	のり巻き	5	5	0.003	5	15	○	○
実施例12	1	82	13	巻き込み	5	5	0.002	5	20	○	○
実施例13	1	82	13	ひだ折り	1	1	0.001	5	20	○	○
実施例14	1	82	13	筒状体	10	10	0.001	5	35	○	○
比較例1	1	76	18	のり巻き	5	5	0.003	5	10	×	△
比較例2	1	72	11	のり巻き	5	5	0.006	5	8	○	△
比較例3	−	80	12	のり巻き	5	5	0.004	5	10	○	○

[0091]
[Effect of the Invention] The filter cartridge of this invention can be balance in properties, such as the stability of dipping nature, a filtration life, and a filtration accuracy, compared with the thing which bound spun yarn in the shape of Aya as the first filter layer, or the filter cartridge which rolled the

nonwoven fabric in the shape of a sushi roll with seaweed. Without crushing a rib-like object, since it is hard to receive the filtration pressure of a rib and a perpendicular direction even if a rib compares with an parallel rib-like object, when the rib-like object of the band-like continuous-glass-fiber nonwoven fabric converged so that a part of rib [at least] might become un-parallel especially is used, it is stabilized further and a filtration efficiency can be maintained. Moreover, it became the outstanding thing which does not contain an impurity in filtrate.

[Translation done.]

Drawing selection drawing 1



[Translation done.]

* NOTICES *

1. This document has been translated by computer.So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The filter cartridge which consists of the first filter layer which comes to twist around a cylindrical shape the band-like continuous-glass-fiber nonwoven fabric which consisted of thermoplastic fiber and a part of the fiber intersection [at least] has pasted up in the shape of Aya, and the second filter layer whose initial 80% uptake particle size is 0.05 to 0.9 times [of the first filter layer] the initial 80% uptake particle size.
[Claim 2] The filter cartridge according to claim 1 which is the heat adhesive property bicomponent fiber whose melting point difference of both those resins thermoplastic fiber consists of a low melting point resin and a high-melting point resin, and is 10 degrees C or more.
[Claim 3] a low melting point resin -- a line -- the filter cartridge according to claim 2 whose high-melting point resin it is a low density polyethylene and is polypropylene
[Claim 4] A filter cartridge given in any 1 term of the claims 1-3 which the fiber intersection has pasted up by the thermocompression bonding according [a band-like continuous-glass-fiber nonwoven fabric] to a heat embossing roll.
[Claim 5] A filter cartridge given in any 1 term of the claims 1-3 which the fiber intersection has pasted [the band-like continuous-glass-fiber nonwoven fabric] up by hot blast.
[Claim 6] A filter cartridge given in any 1 term of the claims 1-5 by which the twist was added to the band-like continuous-glass-fiber nonwoven fabric.
[Claim 7] A filter cartridge given in any 1 term of the claims 1-5 which used the band-like continuous-glass-fiber nonwoven fabric as the rib-like object which has the rib of 4-50, and were twisted around the perforated tube-like object in the shape of Aya.
[Claim 8] The filter cartridge according to claim 7 to which a part of rib [at least] of a rib-like object is not parallel.
[Claim 9] The filter cartridge according to claim 7 whose voidage of a rib-like object is 60 - 95%.
[Claim 10] A filter cartridge given in any 1 term of the claims 1-9 whose voidage of the first filter layer of a filter cartridge is 65 - 85%.
[Claim 11] A filter cartridge given in any 1 term of the claims 1-10 whose products of the eyes (g/m2) of width of face (cm) and a band-like continuous-glass-fiber nonwoven fabric a band-like continuous-glass-fiber nonwoven fabric carries out the slit of the continuous-glass-fiber nonwoven fabric of large width of face, and it is obtained, and the width of face is 0.5cm or more, and are 200 or less.
[Claim 12] The filter cartridge according to claim 1 whose second filter layer is that around which the perforated sheet is wound in the shape of a sushi roll with seaweed around the perforated tube-like object.
[Claim 13] a filter layer which twisted around the cylindrical shape the band-like continuous-glass-fiber nonwoven fabric which the second filter layer became the surroundings of a perforated tube-like object from thermoplastic fiber, and a part of the fiber intersection [at least] has pasted up in the shape of Aya, It is the two-layer structure which consists of a b filter layer continuously twisted around the cylindrical shape in the shape of Aya in the band-like continuous-glass-fiber nonwoven fabric from a filter layer

while involving in the perforated sheet in the shape of a sushi roll with seaweed. The filter cartridge according to claim 1 which is the filter layer by which the first filter layer was continuously twisted around the cylindrical shape in the shape of Aya in the band-like continuous-glass-fiber nonwoven fabric from the second filter layer.
[Claim 14] The filter cartridge according to claim 1 by which the second filter layer bends a perforated sheet in the shape of a pleat around a perforated tube-like object, and is fabricated by tubed.
[Claim 15] The filter cartridge according to claim 1 which is the tubed Plastic solid which the second filter layer consisted of a heat adhesive property bicomponent fiber which consists of two sorts of thermoplastics of 10 degrees C or more of melting point differences, and the intersection of a heat adhesive property bicomponent fiber pasted up.

[Translation done.]